

1 We claim:

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3 1) A tunable optical filter comprising: an expander
4 having an expander extent and a coefficient of expansion;
5 an optical fiber having a grating, said grating having
6 an extent;
7 said expander positioned around said optical fiber, and
8 said optical fiber grating extent included in said extent of
9 said expander extent;
10 said expander bonded continuously to said optical fiber
11 over said extent of said expander;
12 said expander responsive to a control.

13

14 2) The tunable filter of claim 1 where said control is
15 a varying magnetic field.

16

17 3) The tunable filter of claim 2 where said tunable
18 filter includes a magnetic field generator producing a
19 magnetic field which is coupled to said expander.

20

21 4) The tunable filter of claim 3 where said magnetic
22 field generator comprises an coil wound about said expander.

23

24 5) The tunable filter of claim 1 where said control is
25 a varying temperature.

1
2 6) The tunable filter of claim 5 where said tunable
3 filter includes a heating device coupled to said expander.
4

5 7) The tunable filter of claim 1 where said filter is
6 sensing a temperature, and said control comprises the
7 temperature to be sensed.
8

9 8) The tunable filter of claim 1 where said filter is
10 sensing a magnetic field, and said control comprises the
11 magnetic field to be sensed.
12
13

14 9) The tunable filter of claim 1 where said expander is
15 made from $Tb_{0.3} Dy_{0.7} Fe_{1.9}$.
16

17 10) A tunable optical filter comprising: an expander
18 having an expander extent, a coefficient of expansion, a
19 first attachment, and a second attachment, said attachments
20 separated by an attachment extent;

21 an optical fiber having a grating, said grating having
22 a grating extent;

23 said expander positioned around said optical fiber, and
24 said optical fiber grating extent is included in said extent
25 of said attachment extents;

1 said expander bonded to said optical fiber at said
2 first attachment and said second attachment;
3 said expander responsive to a control.
4

5 11) The tunable filter of claim 10 where said control
6 is a varying magnetic field.
7

8 12) The tunable filter of claim 11 where said tunable
9 filter includes a magnetic field generator producing a
10 magnetic field which is coupled to said expander.
11

12 13) The tunable filter of claim 12 where said magnetic
13 field generator comprises an coil wound about said expander.
14

15 14) The tunable filter of claim 10 where said control
16 is a varying temperature.
17

18 15) The tunable filter of claim 14 where said tunable
19 filter includes a heating device coupled to said expander.
20

21 16) The tunable filter of claim 10 where said filter is
22 sensing a temperature, and said control comprises the
23 temperature to be sensed.
24

1 17) The tunable filter of claim 10 where said filter is
2 sensing a magnetic field, and said control comprises the
3 magnetic field to be sensed.

4
5 18) The tunable filter of claim 10 where said expander
6 is made from $Tb_{0.3} Dy_{0.7} Fe_{1.9}$.

7
8 19) The tunable filter of claim 10 where said expander is
9 made from zinc.

10
11 20) A tunable optical filter comprising: an optical
12 fiber having a grating, said grating having an extent;
13 an expander having an expander extent, a coefficient of
14 expansion, a first attachment, and a second attachment, said
15 attachments positioned at opposite ends of said expander;
16 a first expansion extent reducer coupled to said
17 expander said first attachment, said expansion extent
18 reducer having a fiber attachment bonded to one end of said
19 optical fiber grating extent;
20 a second expansion extent reducer coupled to said
21 expander said second attachment, said expansion extent
22 reducer having a fiber attachment bonded to the other end of
23 said optical fiber grating extent;

1 said expansion extent reducers having a coefficient of
2 expansion value which is less than half of said expander
3 coefficient of expansion;

4 said expansion extent reducers fiber attachments having
5 an extent which includes said extent of said optical fiber
6 grating;

7 said expander responsive to a control.

8
9 21) The tunable filter of claim 20 where said control
10 is a varying magnetic field.

11
12 22) The tunable filter of claim 21 where said tunable
13 filter includes a magnetic field generator producing a
14 magnetic field which is coupled to said expander.

15
16 23) The tunable filter of claim 22 where said magnetic
17 field generator comprises an coil wound about said expander.

18
19 24) The tunable filter of claim 20 where said control
20 is a varying temperature.

21
22 25) The tunable filter of claim 24 where said tunable
23 filter includes a heating device coupled to said expander.

1 26) The tunable filter of claim 20 where said filter is
2 sensing a temperature, and said control comprises the
3 temperature to be sensed.

4
5 27) The tunable filter of claim 20 where said filter is
6 sensing a magnetic field, and said control comprises the
7 magnetic field to be sensed.

8
9 28) The tunable filter of claim 20 where said expander
10 is made from Terfenol™.

11
12 29) The tunable filter of claim 20 where said expander
13 is made from zinc.

14
15 30) A tunable filter comprising: ✓
16 an optical fiber having a grating, said grating having
17 a grating extent;
18 a first tube with said optical fiber inside said tube,
19 said optical fiber bonded to said first tube on one side of
20 said grating extent;
21 a second tube with said optical fiber inside said tube,
22 said optical fiber bonded to said second tube on opposite
23 side of said grating extent;
24 one or more expanders surrounding said first and said
25 second tube, said one or more expanders of similar length

1 and collectively having a first end and a second end
2 opposite said first end, said first end bonded to said first
3 tube and said second end bonded to said second tube.

4
5 31) The tunable filter of claim 30 where said expanders
6 are made from Terfenol™.

7
8 32) The tunable filter of claim 30 where the number of
9 said expanders is 3.

10
11 33) The tunable filter of claim 30 where the number of
12 said expanders is 4.

13
14 34) The tunable filter of claim 30 where said expanders
15 are rods.

16
17 35) The tunable filter of claim 30 where said expander
18 first end bonded to said first tube includes a first end
19 stop bonded to said first tube, said first end stop having
20 an extent which includes said expander first end.

21
22 36) The tunable filter of claim 30 where said expander
23 second end bonded to said second tube includes a second end
24 stop bonded to said second tube, said second end stop having
25 an extent which includes said expander second end.

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